to compare it with the pollen of *Nothoscordum borbonicum* Kunth, *Tulbaghia simmleri* P. Beauv. en *T. violaceae* Harv. Floral material of the four species was collected from the gardens of the North-West University (NWU) campus and a special collection held at the NWU-botanical garden. Pollen was examined with scanning electron- and light microscopy. The pollen morphology of the four species is perprolate and monosulcate, and the surface sculpturing is reticulate and heterobrochate. The pollen of *Prototulbaghia siebertii* however, displays a unique characteristic as the grains fold breadth-wise causing the tips to touch. Hence, the grain displays a triangular shape and has a disulcate appearance. Two hypotheses can be formulated to explain this phenomenon. The folding can either be due to the process of harmomegathy or a still unknown event that occurs during the development of the pollen grain. These processes will be investigated further to determine the mechanism of the folding, whether it is a unique taxonomic character for the genus, and whether it is of evolutionary significance within the Alliaceae.

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## Regulation of bioactive secondary metabolite production in *in vitro*-derived greenhouse-grown *Aloe arborescens*

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Auxins and cytokinins are known to interact at different levels in synergistic, antagonistic or additive ways to produce or regulate physiological effects. The effects of cytokinins as well as auxin and smoke-water (SW) treatments applied during the shoot regeneration and rooting phases respectively, on secondary metabolite production of *in vitro*-derived *Aloe arborescens* were evaluated after two months of growth in the greenhouse. The cytokinins used during shoot regeneration were 6-benzyladenine (BA), *meta*-topolin (*m*T) and their derivatives while indole-butyric acid (IBA) and SW were used for rooting. In Me*m*T-regenerated shoots, the treatment with either SW or IBA during rooting significantly increased total phenolic and flavonoid contents when compared to those rooted without plant growth regulators (PGR). On the other hand, *m*T, Me*m*TR and Me*m*TTHP regenerated shoots which were rooted on PGR-free medium, yielded a significantly higher flavonoid content when compared to those rooted on SW and/or IBA-containing medium. Regenerated shoots from BAR-containing medium rooted using SW treatment gave a significantly higher iridoid level compared to those rooted using IBA or without PGR. Conversely, significantly lower iridoid levels were observed with regenerated shoots from BA, *m*T and *m*TR-containing media rooted with IBA or SW when compared to those rooted without PGR. Regenerated shoots from *m*TR and Me*m*T-containing media rooted with SW showed a significantly reduced radical scavenging activity when compared to those rooted without PGR. Shoots regenerated from BA, BAR and Me*m*TTHP-containing media and rooted with SW demonstrated a significantly higher radical scavenging activity when compared to those rooted without PGR. Taken together, the cytokinin type used during shoot proliferation stages and the rooting treatment applied, individually and interactively had a significant carry-over effect on the production of bioactive secondary metabolite in *A. arborescens*.

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## The role of cytokinins on the antioxidant capacity and phenolic acid content during tissue culture and acclimatization of *Merwilla plumbea*

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*Merwilla plumbea* (Lindl.) Speta, a member of the Hyacinthaceae is a popular South African medicinal plant which is currently threatened in the wild. Cultivation using tissue culture techniques could alleviate pressure on wild populations. Nevertheless, there is no adequate literature on the phytochemical and pharmacological efficacy of tissue cultured *M. plumbea*. In addition effects of the series of events that occur during tissue culture and acclimatization on the production of bioactive constituents remain intricate and poorly-understood. Hence, we evaluated the effect of five cytokinins (isoprenoid and aromatic) on the antioxidant activity and phenolic acid content of *M. plumbea* during tissue culture and acclimatization stages. *Meta*-topolin riboside-treated and control plantlets had the best ORAC activity during tissue culture and acclimatization stages, respectively. Generally, the antioxidant activity increased in the aerial parts and decrease in the underground parts after acclimatization. Remarkably, the level of phenolic acids such as protocatechuic acid, 4-hydroxybenzoic acid, caffeic acid and vanillic acid were generally higher in the plant parts and stages which demonstrated better antioxidant activity. The current findings highlight the great chemical variations that could result from the type of applied cytokinin. The use of the right cytokinin is required to guarantee the presence of bioactive chemicals and subsequently the efficacy of micropropagated *M. plumbea*.

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## Are long-term stored medicinal plants as active as the freshly harvested materials?

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Medicinal plant materials are usually stored for a period of time by plant gatherers, traders or traditional healers before usage. Questions that frequently arise are: Do such plant materials retain their biological efficacy?; Are they safe for consumption after a long period of storage? In the present study, the iridoid and phenolic contents as well as the antioxidant and mutagenic properties of five South African medicinal plants stored for 16 years were compared to those of freshly harvested materials. The iridoid content of the freshly harvested materials of *Ocotea bullata*, *Protorhus longifolia* and *Ziziphus mucronata* were significantly higher when compared to the stored materials. Stored *Acokanthera oppositifolia* material had a significant higher iridoid content compared to the freshly harvested material. The total phenolic and flavonoid contents recorded in all freshly collected materials (except *Artemisia afra*) were significantly higher than the

stored ones. With the exception of *A. oppositifolia* and *P. longifolia*, a significantly higher radical scavenging activity was observed in the stored compared to fresh materials. There was no significant difference in the antioxidant activity based on the β-carotene-linoleic acid model between the stored and fresh materials. Extract obtained from freshly harvested *A. oppositifolia* showed a mutagenic effect at 5 mg/ml against *Salmonella typhimurium* TA 1535 strain whereas no such effect was recorded in the stored material. There was no mutagenic effect detected in both the stored and fresh materials of other plant species. The results suggest that stored plant materials can still be biologically potent and possibly safe to use after prolonged storage. However, it would be prudent to study each plant individually, particularly those that may contain poisonous compounds.

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## Critical discerning characters of *Solanum* Linn species (Solanaceae)

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The genus *Solanum* is difficult and complex taxonomically due to the gross morphological variability between and within species as a result of human interference and other factors. This study investigated some species in the genus *Solanum* with a view to resolving some of these conflicting taxonomic issues, using numerical evaluation with a greater advantage of combination of sixty-two (62) characters which are representatives of both morphological (vegetative and floral) and anatomical characters of the species of *Solanum* and observations were made on ten species of *Solanum.* Principal Component Analysis (PCA) and Single Linkage Cluster Analysis (SLCA) were employed to elucidate the relationship among the taxa. The resulting dendrogram showed the grouping of the taxa into two major clusters. Our results showed clear separation of *S. nigrum and S. americanum.* Principal Component Analysis factor loading of the characters showed that characters such as leaf base, stomata type, trichome type, guard cell area on adaxial surface and crystal type were important in delimiting the taxa studied. It was concluded that *S. americanum* and *S. nigrum* which were considered synonyms were distinct species while *S. anomalum* was closely related to the section of *Oliganthes* and distant to *Torva* where it was classified.

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## Promotion of aromatic orchids endemic to the Mascarene Islands within a framework of sustainable development

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*Jumellea fragrans* and *Jumellea rossii*, both named "Faham", are two epiphytic orchids endemic to the Mascarene Islands (Reunion, Mauritius) widely used for their aromatic and medicinal properties. Cultivation of these orchids is currently non-existent, so gathering and poaching in natural populations provide the supply. Continued use of this resource and the reduction of its natural habitat now result in a drastic decline of its natural populations. In order to prevent the decline of these taxa, to preserve its natural evolution in the wild, and to answer to the local consumers demand, we initiate a multidisciplinary project. The main aim of the so-called "ORCHIFAH" project is to provide the scientific background requisite for the production of Faham at an industrial level. An ecological approach is set to characterise the environmental conditions (light, temperature, watering) for an optimal biomass production. *In vitro* conditions of asymbiotic germination are currently determined. The biochemical components variation of populations of the two species are analysed by RMN spectrometry. The development of an appropriated extractive mode of volatile compounds is planned. All this information will help us to accurately characterise the biology of Faham and the conditions of its production, essential prerequisites for the development of an agricultural production chain. The results will also allow us to determine the conservation status of the species and recommendations for the management of wild populations. The poster will explicit the different steps of the implementation of an agricultural production chain. The first results in each field will be presented.

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## Plant diversity, morphology and physiology on the seasonally snow abundant niches of the Drakensberg Alpine Centre, Lesotho

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Mountains are one of the most important and yet environmentally sensitive habitats in the world, they act as reservoirs of species, and have frequently served as refugia for organisms during periods of climate change and provided subsequent sources for speciation. As temperatures increase due to global climate change, species are shifting to higher altitudes to escape the effects of warming at lower altitudes. The aim of this study is to investigate the environmental conditions of alpine species which survive in seasonally snow-covered areas along high altitude south-facing sites at the base of rock scarps. This study was undertaken near Kotisephola Pass in the Drakensberg at ca. 3300 m.a.s.l. The study site portrays botanical micro-zonation below a rock scarp, which is a likely function of long-lasting snow banks in deeply shaded areas lasting for ~six months. The snow melts faster with increasing distance from the scarp face. Three zones were identified; these reflect variations in vegetation and are characterised by distinct *Helichrysum* species. Temperature, solar radiation, snow longevity/depth and soil moisture were measured using Hobo and Tinytag data loggers in all three zones to monitor changes over the five winter months when the plants are covered by various depths of snow. In addition, air temperature and humidity were measured at hourly intervals on plant canopies and stems using iButton temperature loggers in the three zones. Temperature variation across the zones was recorded during both snow accumulation and gradual snow melt through the five months and demonstrates contrasting environmental conditions associated